Self-Reported Body Mass Index and Health-Related Quality of Life: Findings from the Behavioral Risk Factor Surveillance System

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Abstract

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Objective: To examine the relationship between self-reported body mass index (BMI) and health-related quality of life in the general adult population in the United States.

Research Methods and Procedures: Using data from 109,076 respondents in the 1996 Behavioral Risk Factor Surveillance System, we examined how self-reported BMI is associated with five health-related quality of life measures developed by the Centers for Disease Control and Prevention for population health surveillance.

Results: After adjusting for age, gender, race or ethnicity, educational attainment, employment status, smoking status, and physical activity status, participants with a self-reported BMI of <18.5 kg/m^2 and participants with a self-reported BMI of ≥ 30 kg/m^2 reported impaired quality of life. Compared with persons with a self-reported BMI of 18.5 to <25 kg/m^2, odds ratios (ORs) of poor or fair self-rated health increased among persons with self-reported BMIs of <18.5 (1.57, 95% confidence interval [CI]: 1.31 to 1.89), 25 to <30 kg/m^2 (1.12, 95% CI: 1.04 to 1.20), 30 to <35 kg/m^2 (1.65, 95% CI: 1.50 to 1.81), 35 to <40 kg/m^2 (2.58, 95% CI: 2.21 to 3.00), and ≥ 40 kg/m^2 (3.23, 95% CI: 2.63 to 3.95); ORs for reporting ≥ 14 days of poor physical health during the previous 30 days were 1.44 (95% CI: 1.21 to 1.72), 1.04 (95% CI: 0.96 to 1.14), 1.32 (95% CI: 1.19 to 1.47), 1.80 (95% CI: 1.52 to 2.13), and 2.37 (95% CI: 1.90 to 2.94), respectively; ORs for having ≥ 14 days of poor mental health during the previous 30 days were 1.18 (95% CI: 0.97 to 1.42), 1.02 (95% CI: 0.95 to 1.11), 1.22 (95% CI: 1.10 to 1.36), 1.68 (95% CI: 1.42 to 1.98), and 1.66 (95% CI: 1.32 to 2.09), respectively.

Discussion: In the largest study to date, low and increased self-reported BMI significantly impaired health-related quality of life. Particularly, deviations from normal BMI affected physical functioning more strongly than mental functioning.

Key words: body mass index, health surveys, health status, quality of life

Introduction

Obesity is increasingly recognized as a public health concern in the United States because of its adverse consequences, such as diabetes mellitus, heart disease, various cancers, and arthritis (1). Although obese persons may experience a diminished health-related quality of life (2), few population-based studies relating obesity to health-related quality of life are available. Early evidence of health-related quality of life impairment among obese individuals was provided by surgical intervention studies, which reported improvement in quality of life to be an important treatment outcome (3,4). At the opposite end of the weight spectrum, underweight is associated with increased mortality (5). Less is known about health-related quality of life among underweight persons than among obese persons, however.

Although more recent studies have resulted in renewed attention to the relationship between quality of life and being overweight (6–13), this research has generally been limited to special populations or to studies conducted outside the United States. Because the prevalence of overweight and obesity varies widely across cultures (14–16)

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and because the impact of obesity may, in part, be culturally determined, we used data from the 1996 Behavioral Risk Factor Surveillance Survey (BRFSS) to examine the association between health-related quality of life and self-reported body mass index (BMI) in a large sample of U.S. adults. We explored this relationship across age groups, among men and women, and among different racial or ethnic groups in the United States.

Research Methods and Procedures

Since 1983, the Centers for Disease Control and Prevention (CDC) has supported state-based telephone surveys of risk factors for chronic disease (17–19). The BRFSS is a standardized telephone survey carried out by health agencies in states and in the District of Columbia with assistance from the CDC. The primary purpose of the BRFSS is to provide state-specific estimates of the prevalence of behaviors that relate to the leading causes of death in the United States. Each participating state selects for interviewing an independent probability sample from adult residents aged 18 years or older in households with telephones. All states in a given year use an identical core questionnaire administered over the telephone by trained interviewers (17–19). Using the formula developed by the Council of American Survey Research Organizations, the median response rate for 1996 was 63.1%, and the range was 45.6% to 87.1%.

In 1993, four health-related quality of life questions were first added to the core BRFSS. We used 1996 data because in that year all 50 states participated in the BRFSS, and these data included other questions addressing suspected covariates. The four health-related quality of life questions were the following: 1) "Would you say that in general your health is excellent, very good, good, fair, or poor?"; 2) "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?"; 3) "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?"; and 4) "During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?"

The four-item set of health-related quality of life questions was developed by the CDC based on the need for brief and valid measures for use in tracking physical and mental health trends and disparities in general populations (20). The first self-rated general health question has been extensively studied, has been found to predict mortality and health services utilization (21,22), and is sometimes used as a proxy measure for chronic health conditions. Responses to the next two questions asking about the number of recent days when physical or mental health was poor, when added together in an unhealthy days index, provide a measure of health-related quality of life that explicitly includes mental as well as physical health and a specific time-frame reference lacking in the self-rated health measure (23). The recent activity days question has similar properties, but rather than tracking perceived unhealthy days, it uses a more severe health standard (i.e., limitation of usual activity) and has been found to be a useful indicator of disability (24,25).

Along with an expanded set of CDC-developed health-related quality of life questions used optionally by many states, these core BRFSS questions, despite their brevity, have good construct validity (26) and reasonably good criterion validity with respect to the Rand Corporation's Medical Outcomes Study Short-Form 36 (SF-36), in both healthy and disabled populations (27,28).

We calculated BMI from self-reported height and weight. Using the World Health Organization guidelines, we created six categories of BMI: underweight (<18.5 kg/m^2), normal weight (18.5 to <25 kg/m^2), overweight (25 to <30 kg/m^2), obesity class I (30 to <35 kg/m^2), obesity class II (35 to <40 kg/m^2), and extreme obesity (≥ 40 kg/m^2) (29). We deleted a few respondents whose BMI was <12 kg/m^2.

We used the following covariates: age; gender; race or ethnicity (non-Hispanic white, African American, and Hispanic); educational attainment (never attended school or only attended kindergarten, grades 1 through 8, grades 9 through 11, high school graduate, some college or technical school, college graduate); employment status (employed for wages, self-employed, out of work for >1 year, out of work for <1 year, homemaker, student, retired, unable to work); smoking status (current, former, never); and physical activity (none, light, moderate, vigorous). A current smoker was defined as someone who had smoked at least 100 cigarettes and was currently smoking. A former smoker was defined as someone who had smoked at least 100 cigarettes but was not currently smoking. A never smoker was defined as never having smoked 100 cigarettes.

We excluded pregnant women and persons with missing data for any of the quality of life measures, self-reported BMI, or covariates. We calculated means of unhealthy days for the self-reported BMI categories adjusted for the covariates by using analysis of covariance. To examine whether self-reported BMI was independently associated with the quality of life measures, we developed logistic regression models with dichotomized quality of life measures as the dependent variable and self-reported BMI as the variable of interest adjusted for the covariates. We dichotomized responses to the self-rated health question into poor or fair health vs. good, very good, or excellent health, and measures of unhealthy days or activity limitation days into ≥ 14 days and <14 days. When the sum of physical and mental unhealthy days exceeded 30 days, we defined unhealthy days as 30 days. Thus, we assumed no overlap of unhealthy mental and physical days. We used SUDAAN (Software for the Statistical Analysis of Correlated Data; Research Trian-

gle Institute, Research Triangle Park, NC) to account for the complex sampling design of the survey (30). We generated smoothed curves to examine the relationships between mean number of unhealthy days and various covariates in S PLUS using the function loess.

Results

After excluding 1480 women who reported being pregnant and participants with missing data for quality of life measures (n = 3529), self-reported BMI (n = 4844), age (n = 505), race or ethnicity (n = 778), educational status (n = 322), smoking status (n = 326), physical activity level (n = 1497), and employment status (n = 3260) from the 124,085 BRFSS respondents, 109,076 persons (47,066 men and 62,010 women) (88% of all respondents) were included in the analyses. Of these, 2.5% had a self-reported BMI of <18.5 kg/m^2, 46.3% had a self-reported BMI of 18.5 to <25 kg/m^2, 35.6% had a self-reported BMI of 25 to <30 kg/m^2, 11.2% had a self-reported BMI of 30 to <35 kg/m^2, 3.1% had a self-reported BMI of 35 to <40 kg/m^2, and 1.4% had a self-reported BMI of ≥40 kg/m^2.

Age, the percentage of men, and the percentage of individuals who were employed showed inverted V-shaped relationships with self-reported BMI, whereas the percentage of whites or current smokers generally decreased as self-reported BMI increased. Except for the leanest participants, the percentage of participants with a high school education or who were moderately or vigorously active decreased as self-reported BMI increased.

All measures of quality of life were related to self-reported BMI in a U-shaped fashion (Table 1). The lowest means occurred in the 18.5 to <30 kg/m^2 range. As self-reported BMI increased above or decreased below this range, physical health, mental health, and activity limitation worsened. Adjusting for covariates only marginally affected these relationships.

We also examined the relationships between the number of unhealthy days and self-reported BMI by age, gender, race or ethnicity, educational status, smoking status, physical activity status, and employment status (Figures 1 through 7). The mean overall number of unhealthy days was nonlinearly (J- or U-shaped) related to self-reported BMI (with increased variability at the extremes of self-reported BMI for some groups). Mean number of unhealthy days increased with increasing age (Figure 1). Women who had a self-reported BMIs of >20 kg/m^2 experienced more unhealthy days than did men with the same self-reported BMIs, whereas men whose self-reported BMI fell below 20 kg/m^2 experienced more unhealthy days than did women whose self-reported BMI was below 20 kg/m^2 (Figure 2). The lowest mean number of unhealthy days occurred at a self-reported BMI of ~23 kg/m^2 among women and at 25 kg/m^2 among men. Among men, both mean number of unhealthy mental days and mean number of unhealthy physical days increased as BMI decreased to <25 kg/m^2. Among women, only unhealthy mental days increased as self-reported BMI decreased to <23 kg/m^2; no comparable increase was observed in unhealthy physical days. Although mean unhealthy mental days increased with an increasing self-reported BMI of >25 kg/m^2 among men, the increase was less striking than the increase found among women. Over a range of self-reported BMIs of ~20 to 35 kg/m^2, the mean number of unhealthy days among the different race or ethnic groups varied little (Figure 3). At self-reported BMIs of >40 kg/m^2, however, African Americans reported more unhealthy days than whites, whereas at self-reported BMIs of <20 kg/m^2, whites reported more unhealthy days than African Americans. For low and high ranges of self-reported BMI, Hispanics reported the lowest number of unhealthy days of the three race/ethnic groups. Mean number of unhealthy days increased as educational attainment decreased (Figure 4). Persons who were current smokers reported more unhealthy days than respondents who were either former smokers (for a BMI of <40 kg/m^2) or who had never smoked (Figure 5). Regardless of self-reported BMI, respondents who were moderately or vigorously active reported fewer unhealthy days than did those respondents who reported no or light activity (Figure 6).

Compared with respondents who had a self-reported BMI of 18.5 to <25 kg/m^2 and after adjusting for covariates, risk for poor or fair health increased for those with lower self-reported BMIs (<18.5 kg/m^2: odds ratio [OR] = 1.57, 95% confidence interval [CI] = 1.31 to 1.89) or for participants with higher self-reported BMIs (25 to 30 kg/m^2: OR = 1.12, 95% CI = 1.04 to 1.20; 30 to <35 kg/m^2: OR = 1.65, 95% CI = 1.50 to 1.81; 35 to <40 kg/m^2: OR = 2.58, 95% CI = 2.21 to 3.00; ≥40 kg/m^2: OR = 3.23, 95% CI = 2.63 to 3.95). Among men, significant increases in ORs were noted for respondents with a self-reported BMI of <18.5 kg/m^2 and for respondents with a self-reported BMI of ≥35 kg/m^2 for each of the four other health-related quality of life measures (Table 2). Among women, significant increases in ORs were observed for respondents with a self-reported BMI of ≥30 kg/m^2 for these four measures. In general, the ORs were larger for unhealthy physical days than for unhealthy mental days.

We also calculated ORs for the associations between self-reported BMI and quality of life after dichotomizing BMI at 25 kg/m^2 and 30 kg/m^2. After adjusting for age, gender, race or ethnicity, education, employment status, smoking status, or physical activity, the ORs for experiencing ≥14 unhealthy physical or mental health days among those with a self-reported BMI of ≥25 kg/m^2 compared with those with a self-reported BMI of <25 kg/m^2 were 1.18 for all participants (95% CI: 1.11 to 1.24), 1.02 for men (95% CI: 0.93 to 1.12), and 1.32 for women (95% CI: 1.23 to 1.41). Using a cutoff point of 30 kg/m^2, the ORs were

Table 1. Means and percentages (and their SEs) of selected characteristics and measures of health-related quality of life by self-reported BMI categories (1996 BRFSS)

	BMI (kg/m^2)					
	<18.5 (*n* 2,826)	18.5 to <25 (*n* 51,535)	25 to <30 (*n* 37,633)	30 to <35 (*n* 12,148)	35 to <40 (*n* 3,336)	≥40 (*n* 1,598)
Demographic characteristics						
Age	40.4 (0.6)	43.0 (0.1)	46.5 (0.1)	46.8 (0.2)	46.2 (0.4)	44.6 (0.5)
% Men	19.0 (1.3)	42.1 (0.4)	62.6 (0.4)	52.6 (0.7)	44.3 (1.3)	34.0 (1.9)
% White	79.0 (1.3)	78.1 (0.3)	75.3 (0.4)	72.4 (0.7)	67.7 (1.3)	64.2 (2.0)
% ≥High school	84.3 (1.2)	89.0 (0.2)	86.6 (0.3)	83.0 (0.5)	79.6 (1.1)	81.1 (1.5)
% Current smoker	35.1 (1.4)	25.3 (0.3)	22.3 (0.3)	19.8 (0.6)	18.7 (1.0)	21.4 (1.7)
% Moderately or vigorously active	39.0 (1.4)	46.2 (0.3)	43.0 (0.4)	36.0 (0.7)	31.2 (1.2)	24.8 (1.7)
% Employed	48.5 (1.5)	63.5 (0.3)	66.7 (0.4)	64.3 (0.7)	60.3 (1.3)	59.3 (1.9)
% Unemployed	4.6 (0.5)	3.9 (0.1)	3.6 (0.2)	4.7 (0.4)	5.7 (0.6)	7.4 (1.1)
Quality of life measures						
Unhealthy days (physical)						
Unadjusted	4.0 (0.2)	2.5 (0.0)	2.7 (0.1)	3.8 (0.1)	5.3 (0.3)	6.5 (0.4)
Adjusted*	3.7 (0.2)	2.8 (0.1)	2.9 (0.1)	3.5 (0.1)	4.4 (0.2)	5.2 (0.3)
Unhealthy days (mental)						
Unadjusted	4.0 (0.2)	2.8 (0.0)	2.5 (0.1)	3.3 (0.1)	4.4 (0.2)	4.9 (0.3)
Adjusted*	3.3 (0.2)	2.8 (0.0)	2.8 (0.1)	3.3 (0.1)	4.1 (0.2)	4.1 (0.3)
Activity limitation days						
Unadjusted	2.6 (0.2)	1.4 (0.0)	1.5 (0.0)	2.2 (0.1)	3.5 (0.2)	3.7 (0.3)
Adjusted*	2.4 (0.2)	1.6 (0.0)	1.6 (0.0)	2.0 (0.1)	2.8 (0.2)	2.7 (0.2)
Unhealthy days (physical and mental)						
Unadjusted	7.0 (0.3)	4.8 (0.1)	4.7 (0.1)	6.2 (0.1)	8.4 (0.3)	9.9 (0.4)
Adjusted*	6.0 (0.3)	4.9 (0.1)	5.1 (0.1)	5.9 (0.1)	7.4 (0.3)	8.3 (0.4)

* Adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity.

1.45 for all participants (95% CI: 1.35 to 1.55), 1.37 for men (95% CI: 1.23 to 1.53), and 1.51 for women (95% CI: 1.39 to 1.64).

Discussion

In the largest study yet to examine the relationship between self-reported BMI and health-related quality of life, our results are consistent with findings from previous studies that have shown that overweight and obese persons have a worse health-related quality of life (2,6–13). Our results extend previous findings by showing that the direct associations between excess weight and worse health-related quality of life include all adult age groups, both sexes, and whites, African Americans, and Hispanics. Because we combined representative samples from each of the 50 states, the results of our investigation are generalizable to the U.S. population (31).

In the Swedish Obese Subjects Intervention study, 1743 obese participants had diminished mental well-being and psychosocial functioning compared with 89 healthy reference participants (6). Overweight and obesity were positively associated with physical impairment (defined as an inability to run a short distance, enter a bus without problems, or take a short walk), reduced mobility, back pain, and severe pain in hands and legs in a representative sample of 12,988 men and 13,414 women from Sweden (7).

Using the SF-36 questionnaire, other investigators have found that health and health-related quality of life

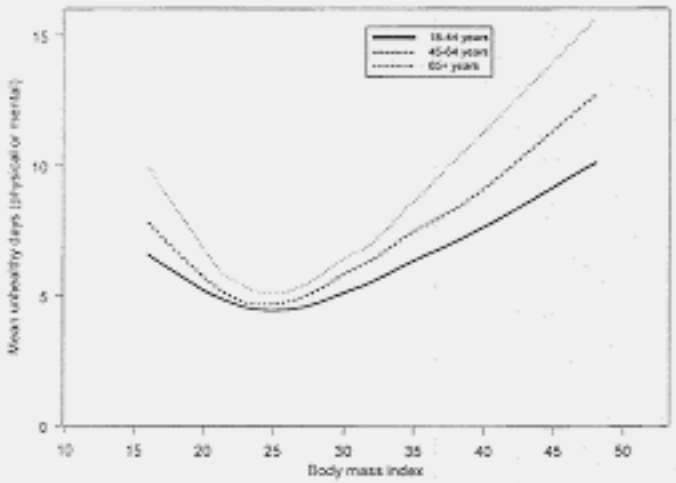

Figure 1. Mean number of unhealthy days (physical or mental), by BMI and by age, from the 1996 BRFSS.

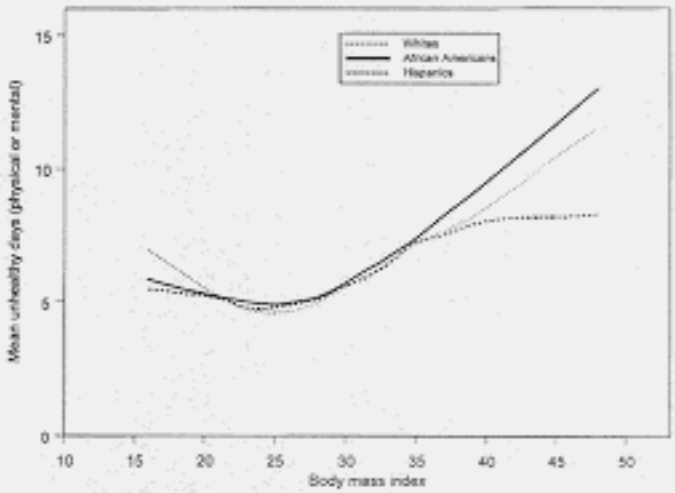

Figure 3. Mean number of unhealthy days (physical or mental), by BMI and by race or ethnicity, from the 1996 BRFSS.

worsened as BMI or waist circumference increased (8,9,11–13). Data from the Monitoring Cardiovascular Health (MORGEN) study in the Netherlands showed that physical functioning and bodily pain were significantly associated with increased BMI among 1885 men and 2156 women (11). In a reanalysis of these data, these associations were similar using BMI categories adopted by the National Institutes of Health and the World Health Organization (13). Among 56,510 participants of the Nurses' Health Study, four scales of a modified version of the SF-36 questionnaire (i.e., physical functioning, vitality, bodily pain, and role functioning) were significantly and inversely related to self-reported BMI (8). In the Whitehall II study, poor physical functioning increased monotonically as BMI increased in 2412 women, whereas poor physical functioning was increased only in 5449 men whose BMI was ≥27 kg/m^2 (12).

In our study, the number of poor physical health days during the previous 30 days (physical functioning) appeared more strongly related to self-reported BMI than the number of days of poor mental health during the previous 30 days (mental functioning). Although the MORGEN researchers found no association between BMI and the mental health components of the SF-36 (9), we did find a significant association between BMI and the risk of having ≥14 unhealthy mental days during the previous 30 days.

That many obese persons experience a diminished health-related quality of life is not surprising. Obese persons are more likely than persons who are not obese to suffer from low self-esteem and depression and to experience poor peer

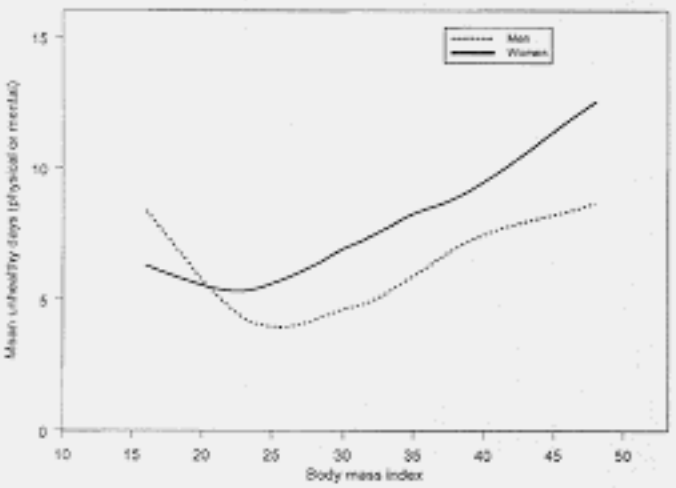

Figure 2. Mean number of unhealthy days (physical or mental), by BMI and by gender, from the 1996 BRFSS.

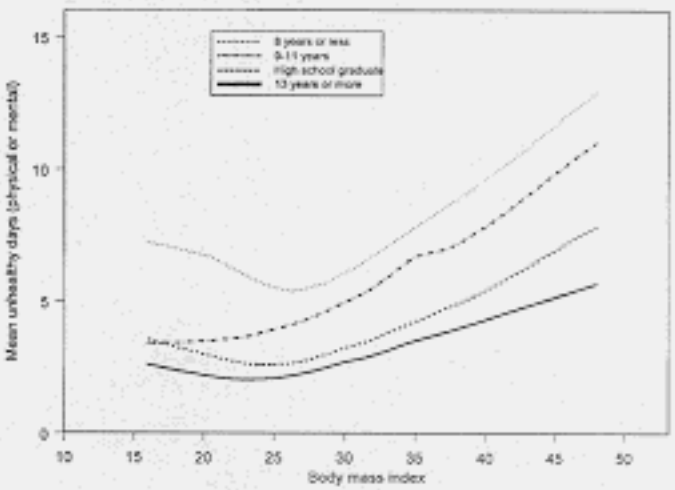

Figure 4. Mean number of unhealthy days (physical or mental), by BMI and by educational status, from the 1996 BRFSS.

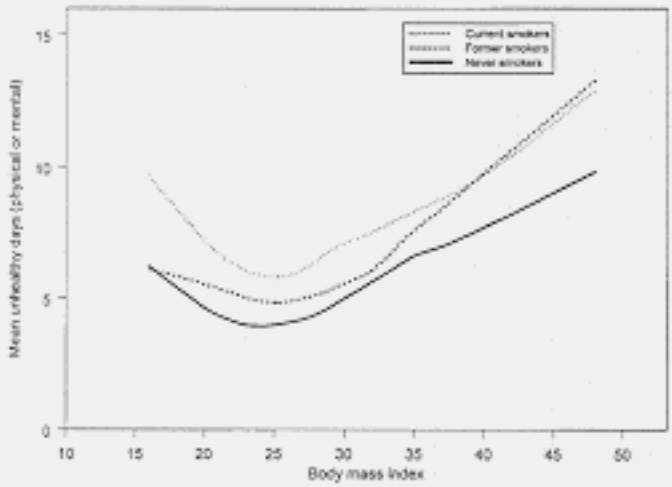

Figure 5. Mean number of unhealthy days (physical or mental), by BMI and by smoking status, from the 1996 BRFSS.

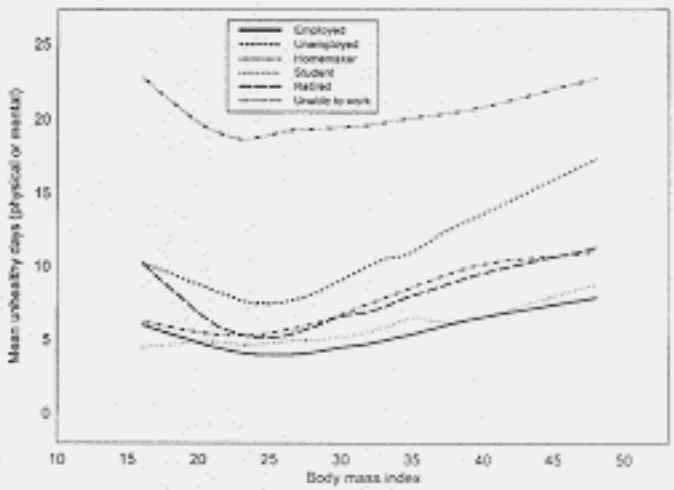

Figure 7. Mean number of unhealthy days (physical or mental), by BMI and by employment status, from the 1996 BRFSS.

relationships (2,10). Prejudice and discrimination directed at obese persons are ubiquitous in U.S. society (32). Many conditions for which obesity increases risk, such as type 2 diabetes and cardiovascular disease, also decrease health-related quality of life (33,34). Furthermore, in at least two prospective studies, overweight persons had an increased risk of disability (35,36).

The increase in unhealthy days among lean respondents is more difficult to explain. Health-related quality of life among very lean persons has not been studied extensively (7). The increased mean number of unhealthy days in such respondents agrees with numerous studies showing increased all-cause mortality at lower BMIs (5). Consistent with previous findings (37), we found low self-reported BMI to be significantly associated with female gender, a risk factor for anorexia nervosa (38), and linked to greater weight loss goals when dieting (39). Lean respondents are likely to be very heterogeneous and include healthy persons who either diet or exercise a lot, persons with eating disorders, and clinically or subclinically sick persons. Such respondents are also more likely to smoke than others. The shape of the relationship between self-reported BMI and the number of unhealthy days (physical or mental) among persons who had never smoked resembled that for the entire analytic sample (data not shown). Unfortunately, the BRFSS does not include information needed to distinguish subgroups (except for current smokers) within lean respondents.

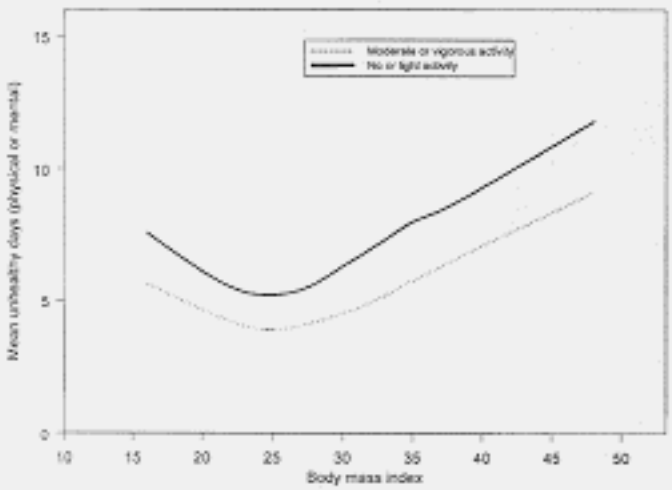

Figure 6. Mean number of unhealthy days (physical or mental), by BMI and by physical activity status, from the 1996 BRFSS.

Similar to many previous studies, our study was cross-sectional. Such a design provides a snapshot of the burden of adverse effects experienced by obese or very lean persons but does not allow conclusions about cause and effect. Thus, although obesity may reduce quality of life, poor quality of life may be due to other factors that led to weight gain. Because weight and height were self-reported in our study, misclassification may have affected our results. Obese persons are more likely to underreport their weights and over-report their heights than are persons who are not obese (thus decreasing calculated BMI), and men are more likely to over-report their heights than are women (4). Reliability studies of the BRFSS questionnaires in various settings have reported κ coefficients of 0.77 to 0.96 for BMI and categories of overweight or obese (41–43) and correlation coefficients of 0.84 to 0.94 for height, weight, and BMI (44). Validity studies of the BRFSS have shown sensitivities of 0.74 to 0.77 and a specificity of 0.99 for obesity (45,46). Correlation coefficients for self-reported height and BMI were 0.94 and 0.96, respectively (45). The prevalence of obesity from a BRFSS survey was ~45% less than that from the Five-

Table 2. Associations between several measures of quality of life and self-reported BMI categories from logistic regression analysis (1996 BRFSS)

	BMI (kg/m^2)					
Outcome	**<18.5**	**18.5 to <25**	**25 to <30**	**30 to <35**	**35 to <40**	**≥40**
Total						
≥14 Days unhealthy days (physical)						
Unadjusted proportion (%, SE)	12.2 (0.9)	7.1 (0.2)	7.9 (0.2)	11.3 (0.4)	16.7 (1.0)	21.4 (1.5)
Crude OR (95% CI)	1.81 (1.53–2.14)	1.00	1.12 (1.04–1.21)	1.67 (1.51–1.84)	2.62 (2.26–3.05)	3.55 (2.95–4.28)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.67 (1.41–1.99)	1.00	1.05 (0.97–1.14)	1.49 (1.35–1.66)	2.35 (2.01–2.75)	3.30 (2.71–4.01)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.44 (1.21–1.72)	1.00	1.04 (0.96–1.14)	1.32 (1.19–1.47)	1.80 (1.52–2.13)	2.37 (1.90–2.94)
≥14 Days unhealthy days (mental)						
Unadjusted proportion (%, SE)	12.1 (0.9)	8.1 (0.2)	7.5 (0.2)	9.9 (0.4)	14.6 (1.0)	16.7 (1.4)
Crude OR (95% CI)	1.55 (1.29–1.85)	1.00	0.91 (0.85–0.99)	1.24 (1.12–1.38)	1.93 (1.65–2.27)	2.26 (1.85–2.77)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.25 (1.04–1.50)	1.00	1.03 (0.95–1.12)	1.33 (1.19–1.48)	1.98 (1.68–2.33)	2.12 (1.72–2.61)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.18 (0.97–1.42)	1.00	1.02 (0.95–1.11)	1.22 (1.10–1.36)	1.68 (1.42–1.98)	1.66 (1.32–2.09)
≥14 Days activity limitation days						
Unadjusted proportion (%, SE)	8.0 (0.7)	4.2 (0.1)	4.5 (0.2)	6.7 (0.4)	11.3 (0.9)	11.9 (1.1)
Crude OR (95% CI)	1.99 (1.62–2.45)	1.00	1.08 (0.98–1.20)	1.63 (1.43–1.87)	2.92 (2.43–3.51)	3.09 (2.50–3.81)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.79 (1.44–2.22)	1.00	1.02 (0.92–1.13)	1.46 (1.27–1.67)	2.57 (2.12–3.10)	2.71 (2.19–3.37)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.47 (1.16–1.85)	1.00	1.01 (0.91–1.13)	1.22 (1.06–1.41)	1.81 (1.46–2.25)	1.61 (1.24–2.09)
≥14 Days unhealthy days (physical or mental)						
Unadjusted proportion (%, SE)	21.1 (1.2)	14.0 (0.2)	13.9 (0.3)	18.8 (0.6)	26.6 (1.2)	33.2 (1.8)
Crude OR (95% CI)	1.65 (1.43–1.90)	1.00	1.00 (0.94–1.06)	1.42 (1.31–1.54)	2.23 (1.97–2.52)	3.06 (2.60–3.60)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.43 (1.23–1.65)	1.00	1.04 (0.97–1.10)	1.39 (1.28–1.52)	2.11 (1.86–2.40)	2.79 (2.36–3.31)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.29 (1.11–1.49)	1.00	1.04 (0.97–1.10)	1.30 (1.19–1.41)	1.79 (1.57–2.04)	2.26 (1.89–2.71)

Table 2. Continued

Outcome	BMI (kg/m^2)					
	<18.5	18.5 to <25	25 to <30	30 to <35	35 to <40	≥40
Men						
≥14 Days unhealthy days (physical)						
Unadjusted proportion (%, SE)	15.9 (2.6)	7.0 (0.3)	6.2 (0.2)	8.7 (0.6)	14.7 (1.5)	18.9 (2.7)
Crude OR (95% CI)	2.54 (1.71–3.75)	1.00	0.89 (0.79–1.01)	1.28 (1.07–1.52)	2.31 (1.78–2.98)	3.12 (2.17–4.49)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.71 (1.11–2.63)	1.00	0.85 (0.75–0.97)	1.08 (0.90–1.29)	1.53 (1.15–2.03)	2.46 (1.64–3.70)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.71 (1.11–2.63)	1.00	0.85 (0.75–0.97)	1.08 (0.90–1.29)	1.53 (1.15–2.03)	2.46 (1.64–3.70)
≥14 Days unhealthy days (mental)						
Unadjusted proportion (%, SE)	13.1 (2.6)	6.7 (0.3)	6.0 (0.2)	7.6 (0.6)	14.4 (1.6)	12.0 (2.4)
Crude OR (95% CI)	2.10 (1.33–3.31)	1.00	0.89 (0.78–1.01)	1.14 (0.95–1.38)	2.34 (1.79–3.06)	1.90 (1.20–3.02)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.76 (1.11–2.80)	1.00	0.93 (0.82–1.06)	1.20 (0.99–1.44)	2.38 (1.82–3.12)	1.85 (1.15–2.98)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.51 (0.91–2.51)	1.00	0.96 (0.85–1.10)	1.16 (0.96–1.39)	2.01 (1.53–2.64)	1.58 (0.92–2.69)
≥14 Days activity limitation days						
Unadjusted proportion (%, SE)	10.6 (2.2)	4.3 (0.2)	3.6 (0.2)	5.5 (0.6)	12.3 (1.5)	8.1 (1.6)
Crude OR (95% CI)	2.65 (1.67–4.21)	1.00	0.83 (0.71–0.97)	1.30 (1.02–1.65)	3.13 (2.34–4.19)	1.98 (1.28–3.06)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	2.11 (1.27–3.53)	1.00	0.79 (0.68–0.92)	1.22 (0.96–1.55)	2.93 (2.19–3.92)	1.85 (1.18–2.90)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.45 (0.80–2.61)	1.00	0.85 (0.72–1.00)	1.11 (0.87–1.40)	2.08 (1.48–2.93)	1.21 (0.76–1.92)
≥14 Days unhealthy days (physical or mental)						
Unadjusted proportion (%, SE)	23.8 (3.3)	12.2 (0.4)	11.2 (0.3)	14.6 (0.8)	22.8 (1.8)	28.2 (3.3)
Crude OR (95% CI)	2.23 (1.56–3.20)	1.00	0.90 (0.82–0.99)	1.22 (1.06–1.41)	2.12 (1.71–2.62)	2.81 (2.03–3.89)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.94 (1.33–2.82)	1.00	0.88 (0.80–0.97)	1.18 (1.03–1.36)	2.01 (1.63–2.50)	2.69 (1.94–3.74)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.59 (1.08–2.36)	1.00	0.92 (0.83–1.02)	1.15 (1.00–1.33)	1.69 (1.35–2.12)	2.41 (1.67–3.49)

Table 2. Continued

Outcome	BMI (kg/m^2)					
	<18.5	18.5 to <25	25 to <30	30 to <35	35 to <40	≥40
Women						
≥14 Days unhealthy days (physical)						
Unadjusted proportion (%, SE)	11.3 (0.9)	7.2 (0.2)	10.8 (0.4)	14.2 (0.6)	18.4 (1.3)	22.7 (1.8)
Crude OR (95% CI)	1.63 (1.36–1.96)	1.00	1.54 (1.40–1.71)	2.13 (1.89–2.39)	2.88 (2.40–3.45)	3.76 (3.03–4.66)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.45 (1.20–1.75)	1.00	1.25 (1.13–1.39)	1.54 (1.35–1.75)	2.01 (1.63–2.48)	2.44 (1.90–3.15)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.45 (1.20–1.75)	1.00	1.25 (1.13–1.39)	1.54 (1.35–1.75)	2.01 (1.63–2.48)	2.44 (1.90–3.15)
≥14 Days unhealthy days (mental)						
Unadjusted proportion (%, SE)	11.8 (1.0)	9.2 (0.2)	9.9 (0.3)	12.4 (0.6)	14.8 (1.2)	19.1 (1.7)
Crude OR (95% CI)	1.33 (1.09–1.61)	1.00	1.09 (0.99–1.20)	1.41 (1.24–1.60)	1.72 (1.41–2.10)	2.34 (1.88–2.91)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.15 (0.95–1.41)	1.00	1.13 (1.03–1.25)	1.43 (1.25–1.62)	1.74 (1.42–2.13)	2.23 (1.77–2.81)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.12 (0.91–1.37)	1.00	1.10 (0.99–1.21)	1.29 (1.13–1.47)	1.50 (1.22–1.85)	1.73 (1.35–2.21)
≥14 Days activity limitation days						
Unadjusted proportion (%, SE)	7.4 (0.8)	4.1 (0.2)	6.1 (0.3)	8.0 (0.5)	10.6 (1.1)	13.9 (1.4)
Crude OR (95% CI)	1.86 (1.47–2.34)	1.00	1.52 (1.33–1.73)	2.02 (1.73–2.36)	2.75 (2.17–3.47)	3.73 (2.94–4.74)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.78 (1.40–2.25)	1.00	1.30 (1.14–1.48)	1.68 (1.43–1.98)	2.33 (1.82–2.98)	3.28 (2.56–4.21)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.52 (1.19–1.95)	1.00	1.21 (1.06–1.39)	1.33 (1.12–1.58)	1.67 (1.26–2.21)	1.89 (1.39–2.56)
≥14 Days unhealthy days (physical or mental)						
Unadjusted proportion (%, SE)	20.5 (1.2)	15.2 (0.3)	18.6 (0.5)	23.4 (0.8)	29.6 (1.5)	35.7 (2.1)
Crude OR (95% CI)	1.44 (1.23–1.67)	1.00	1.27 (1.18–1.37)	1.71 (1.55–1.88)	2.34 (2.01–2.72)	3.10 (2.57–3.74)
OR adjusted for age, gender, race or ethnicity, education, and smoking status (95% CI)	1.35 (1.16–1.58)	1.00	1.20 (1.11–1.29)	1.57 (1.42–1.74)	2.18 (1.87–2.55)	2.88 (2.37–3.50)
OR adjusted for age, gender, race or ethnicity, education, employment, smoking status, and physical activity (95% CI)	1.26 (1.07–1.48)	1.00	1.16 (1.07–1.26)	1.41 (1.27–1.57)	1.87 (1.59–2.21)	2.24 (1.83–2.74)

City Project Survey (47). If little or no misclassification of the reference category occurred, the likely result of misclassification would be relatively accurate ORs for the lowest and highest BMI classes but increased ORs for the intermediate classes. Telephone coverage bias is not likely to have affected these results, because a high proportion of U.S. residents own telephones. The mean BMI for participants with a telephone in the Third National Health and Nutrition Examination Survey resembled that of those without a telephone (48). However, for subgroups of the U.S. population with low telephone coverage, the associations between BMI and quality of life measurements may differ from those described in this article.

In conclusion, this is the largest study to have examined health-related quality of life measures related to self-reported BMI. Our results agree with previous studies and show that health-related quality of life diminishes as BMI increases or decreases from the normal range. With the increasing prevalence of obesity becoming recognized as a public health crisis (49), our results may be useful in better monitoring the full impact of this health condition and its economic consequences. Health-related quality of life measures from population-based studies such as the BRFSS may provide insights into health perceptions that may affect the efforts of individuals to maintain or change their weight.

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